LETTERS TO THE EDITOR.

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Eclipse Photography.

THE writer has obtained results in photography which seem to have an important bearing on the work which should be undertaken in future eclipses.

It is well known that photographic plates exposed in some eclipses have developed no trace of an image of the sun. The astronomer has even been subjected to the mortifying suggestion that he had forgotten to uncap his camera. It is not difficult to reproduce such results at any time by simple over-exposure. In eclipse photography, where it is sought to get the most delicate of details in an object of the most delicate character, the methods now used are hedged in by very peculiar limitations. It requires a very appreciable time to secure delicate details, and, nevertheless, if this time is made too great the plate will fog. The developer must then be given restraining properties, which cause a loss of the very details we are seeking to secure.

In a paper recently published by the Academy of Science of St. Louis, the writer has shown that a plate which, on account of over-exposure will develop as a zero plate in a dark room, will develop as a positive in a light room. The paper contains a half-tone reproduction of a positive obtained by a camera exposure of one minute, and developed within a few inches of a 16-candle incandescent lamp. The plate was an "instantaneous" Cramer plate. Since that time the same results have been reached by first opening up the plate holder and exposing the film to the lamp light until it is all converted into the zero condition. If covered with an opaque punched stencil, no trace of the design will appear on the film when developed in the illuminated bath. The slide is then closed and the plate afterwards exposed in the camera in the usual way. Such a plate cannot be over-exposed in any reasonable time. It may be exposed for a minute or for four hours to a brilliantly-lighted landscape, and the most superb results can be obtained. There is no restraining developer needed. The tendency to fog when the exposure is too short is corrected by taking the developing bath nearer to the light. It seems probable that on very short exposures it might sometimes be advantageous to use a developer which will yield a positive with an under-exposed plate. In the two eclipses of long totality which are now approaching, this method seems to promise very valuable results, and the attention of those who will have the work in charge is earnestly directed to this matter. The results described have been reached but recently, and there is need of preliminary experimenting by any one who wishes to avail himself of these methods.

St. Louis, Missouri, U.S.A. FRANCIS E. NIPHER.

The Action of Water Upon Glass.

IT is a matter of too frequent observation in India that lenses of optical instruments are liable to serious injury from atmospheric influences. This very often takes the form of injury to the Canada balsam cementing the two lenses of achromatic combinations together; but in other cases, it is due to the solvent action of water on the surface of the glass. As this is a matter of importance necessitating the re-grinding of the lens for its correction, I have thought that the following observations may be of interest and of value to optical instrument-makers, especially as it appears that only particular kinds of glass are attacked in this way. If that is so, it should be possible to avoid using glass of that particular composition; or the edges of the combined lenses may be covered with a coating of cement or varnish so as to prevent moisture getting in between them, and in such a way that it could easily be removed when desired.

My attention was first drawn to some cases of articles of domestic glassware being attacked by water standing in them for some time, and these are recorded to show that a solvent action does take place. The first case that I noticed was that of a cut wine glass which was used—or misused—to hold a few cut flowers. On seeing it dry on one occasion, I noticed it had a dull matt appearance, which I thought was simply a deposit. On examination, however, I found that the surface of the glass had been eaten into up to the level of the water usually put into it.

The next case was that of glass finger-bowls, in which the servants kept water ready for use. These were similarly attacked up to the level of the water. The next was a more remarkable case. A couple of decanters, not required for use, had evidently been washed and drained, more or less, but not dried; possibly during the hot season. The moisture remaining inside had become deposited on the inner surface in droplets, as, indeed, may frequently be seen, and had been standing so for some time. When dried for use the surface was found to be eroded, giving a pattern precisely similar to that formed by condensed moisture: leaving no doubt as to its cause.

Here we have, then, a case of pure water attacking the surface of glass when allowed to stand for some time. Since then, being on the alert, I have met other cases, including some of perfectly new glass articles eroded in like manner, which, without their history, it is impossible to account for.

Now for two instances of physical apparatus being attacked and spoiled by this action. The first noticed was a Newton's Rings apparatus. In this case the two discs of glass were equally attacked, and so much so that the combination was of a dense matt appearance. On opening it out, the discs were found to be firmly adhered, and on inserting a knife edge between the discs and giving a sharp tap on the back to separate them, an irregular piece about 1¼ inch long came from one adhering to the other. The two had thus grown together, and at the junction was actually stronger than in the mass of the glass.

The next was a more serious case, being the object lens of a 3½ inch telescope from a well-known London firm of optical instrument-makers. In this case, the convex lens was badly corroded on its inner surface, though the adjacent face of the concave lens was quite clear. Here we see the difference in action in the case of two different kinds of glass. This, however, would help us little if all kinds of crown glass (of which the convex lens is made) were similarly attacked. But this is not the case, and it is a point of importance to opticians to ascertain what particular kinds of crown glass used in achromatic combinations are liable to this action, and to avoid using them. Of a fairly large number of achromatic combinations I have in the College Laboratory, this is the only one that has been affected, though all are exposed to the same influences, while some belong to old pieces of apparatus. The particular telescope was purchased about six years ago, and the damage took place in one season when it was not much used. Since then I have from time to time opened out the lenses and have frequently found a layer of moisture between them; in one case, of a commoner piece of apparatus in which the lenses did not fit closely, a complete drop of water was collected, the diameter of the lens being only 1½ inch; and in a Soleil's saccharimeter, clear through vision is obscured by moisture collected and condensed on the surfaces of the lenses in one of the adjusting pieces, which it is very difficult to open out to clean.

All this shows that moisture does collect in the form of water between such layers of glass, and the pattern of the eroded portion of the telescope lens, together with the instances of the action of water on the domestic glass goods mentioned above, leave no doubt that it was moisture alone that caused the damage in this case, although it was not actually seen. I need hardly say that, in both the Newton's Rings apparatus and the telescope lens, the exposed surfaces were perfectly clear and unacted upon.

The causes of moisture collecting in this way would appear to be the excessive moisture in the air for many months in the year, the hygroscopic nature of the glass, and capillary action between the surfaces; while the apparently marked action of water on glass here noticed is probably due to the long-continued higher temperature. It is possible, however, that the above phenomena may not be as new or unusual as they appear to be to me, and that many others could give like experiences.

EDMUND F. MONDY.

Dacca College, Dacca, East Bengal, June 16.

THE TOTAL SOLAR ECLIPSE AS OBSERVED BY THE SMITHSONIAN EXPEDITION.

WADESBORO, in Northern Carolina, was the station selected by the Smithsonian Institution for observing the total solar eclipse of May 28 last. The chances of fine weather at eclipse time were about eight to one, and it is satisfactory that on eclipse day the sky was cloudless and the air clearer than on the average.

The main objects of the investigations undertaken were a photographic and visual study of the structure of the lower corona, and a determination by the bolometer of the heat radiated from it, and lastly an examination of the form of its spectrum energy curve.

Prof. Langley, who was in charge of this expedition, observed the eclipse of 1878 from Pike's Peak (14,000 feet), and he was then particularly struck by the remarkable definiteness of filamentary structure close to the sun's limb, a structure which, he remarks, has never been found in any photographs, not even in those beautiful pictures taken by Prof. Campbell at the Indian eclipse of 1898. The eclipse this year afforded him an opportunity of examining this inner corona region with a much more powerful instrument. This instrument was a 12-inch achromatic lens of 135 feet focal length, obtained for the Harvard College Observatory, and lent by Prof. E. C. Pickering. The tube was mounted horizontally in conjunction with a cœlostat of 18-inch aperture, and 30-inch square plates were used, the diameter of the solar image being 15 inches. To supplement this instrument, a 5-inch lens of 38 feet focal length, loaned by Prof. Young, was pointed directly at the sun, and photographs were secured on plates 11 by 14 inches, moved in the focus of the lens by a water clock. For the study of the outer corona and possible intramercurial planets, specially equatorially mounted lenses of 6-, 4- and 3-inch apertures, driven by clock-work, were used.

The accompanying illustration (Fig. 1) shows a small part of the 135-foot telescope. The photographic hut is seen at the end of it, and beyond that the tube containing the lens of 38 feet focal length pointed at the sun. Prof. Langley is seen observing at the 5-inch equatorial.

For the bolometric work a massive siderostat with a mirror of 7 inches was used in conjunction with a large part of the delicate adjuncts employed at the Smithsonian Institution in recent years.

Further work that was attempted, and for which other apparatus had been taken out, was an automatic method of obtaining photographs of the lower chromosphere at about second contact by means of an objective prism working in connection with the 135-foot lens; visual and photographic observations of times of contact; and sketches of the corona, both from telescopic and naked eye observations.

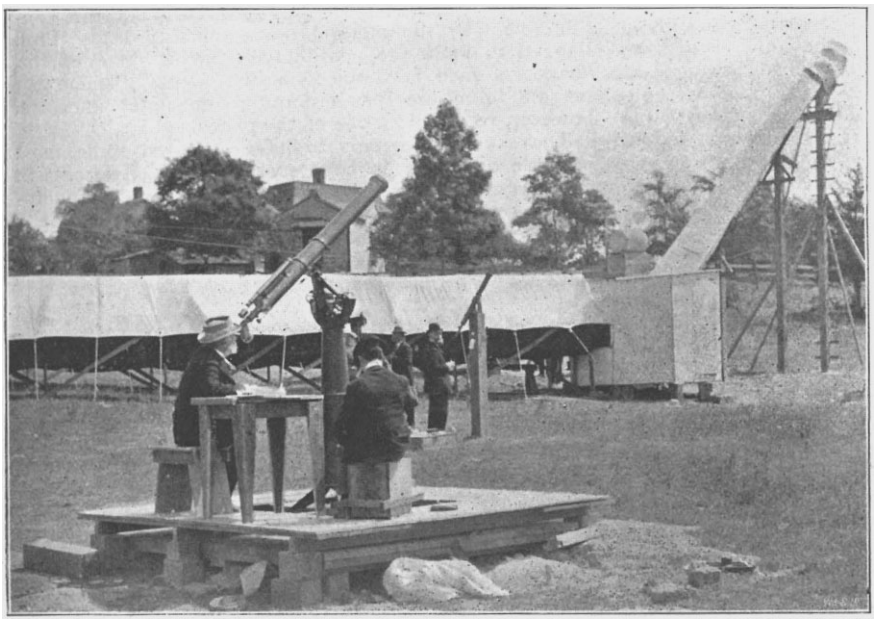

FIG. 1.—Portion of Smithsonian Astrophysical Observatory Eclipse Camp, showing a part of the large 135-foot telescope (under canvas), the 38-foot coronagraph, and the 5-inch equatorial.

The observers, under the general charge of Prof. Langley, were distributed as follows:—Prof. Langley used the same 5-inch as he observed with in 1878; Messrs. Abbot and Mendenhall were in charge of the bolometer; Mr. T. W. Smillie made exposures at the 135-foot telescope, and Mr. F. E. Fowle, jun., at the 38-foot telescope. Father Searle, assisted by Mr. P. A. Draper and Mr. C. W. B. Smith, employed four telescopes, mounted on a single polar axis and driven by clock-work, for obtaining photographs of the outer corona and the intramercurial planets. Latitude, longitude, time and contact observations were made by Mr. G. R. Putnam, assisted by Mr. Hoxie. Sketches of the inner corona and contacts were made by Mr. R. C. Child with a 6-inch, and by Father Woodman with a 3½-inch.

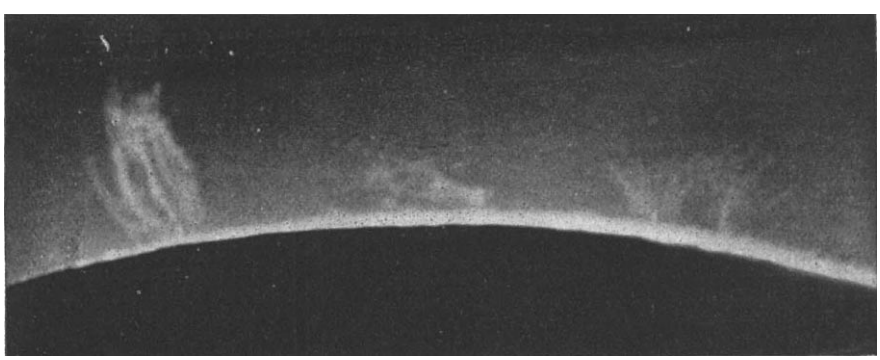

FIG. 2.—Showing prominences at the south-west limb. Taken with a 12-inch lens of 135 feet focal length. Exposure eight seconds. At end of totality. (Natural size of original photograph. Moon, 15 inches diam.).

Among the more general observations made at the time of the eclipse may be mentioned the following:—

Before totality a fall of temperature and a rising breeze were distinctly noticeable. Shadow bands were seen, but their velocity was too rapid and flickering for accurate determination; their size and distance apart (about 5 inches) were also estimated.

During totality the sky to visual observers was notably not dark, and no second magnitude star was seen with the naked eye. Mercury was a conspicuous object

The equatorial streamers were closely observed, and could be followed by the naked eye to 3 or $3\frac{1}{2}$ solar diameters; their structure was likened by Father Woodman to a structure of mother-o'-pearl, and this was generally conceded. Colour estimates, however, varied, and were given as "yellowish green tinge," "straw-coloured" or "golden." (It may be remarked here that the general description of the colour was given by the British observers in Spain and Portugal as "silvery-white.") Prof. Langley's visual telescopic observations gave, as he remarks, "little indication of the finely-divided structure of the inner corona which he had noticed at Pike's Peak. Structure, to be sure, was evident, but not in such minute subdivision as had then been seen; and though one remarkable prominence, as well as several smaller ones, was visible, the coronal streamers did not give to the writer the impression of being connected with these prominences, though the relationship of some of them to the solar poles was abundantly manifest."

The approximate length of totality as observed was 88 seconds, or 4 seconds shorter than the duration as given by the *Nautical Almanac*.

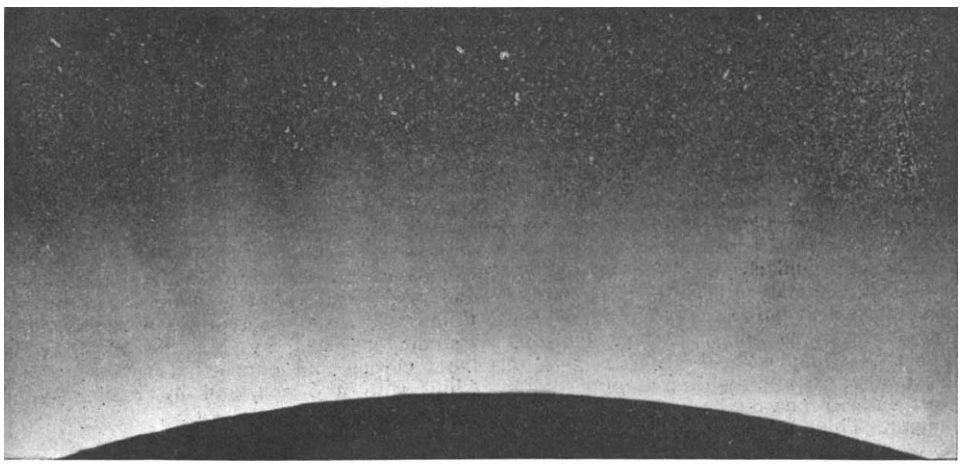

FIG. 3.—North polar coronal region. Taken with a 12-inch lens of 135 feet focal length. Exposure 16 seconds. (Natural size of original photograph. Moon 15 inches diam.)

With regard to the photographs which were found to have been successfully exposed, but of which only a few have as yet been developed, most interesting results will be obtained. During totality six plates were exposed for periods ranging from $\frac{1}{2}$ to 16 seconds, and three others immediately after third contact; these were all secured by the large 135-foot telescope. We are fortunately able to illustrate two portions (natural size) of the large 15-inch disc. Fig. 2 shows one of the principal prominences with the lower filaments near it (exposure 8 seconds), while Fig. 3 is another portion of the north polar region, with a 16 seconds' exposure. The part near the sun has been intentionally over-exposed, to show more clearly the outer portions of the polar structure, which extended to 6 minutes from the sun. The wealth of detail and imposing magnitude of the scale on which these pictures are taken will no doubt give us much needed information about the structure of the corona just above the chromosphere.

The measurement of the heat of the corona appears to have been successfully performed by Mr. Abbot, with the aid of Mr. Mendenhall, and this is probably the first time that it has really been shown to exist. The important result was that the corona gave a positive indication of heat as compared with the moon; this heat though certain, was, we are told, too slight to be subdivided by the dispersion of the prism with the means at hand.

With regard to the negatives depicting the outer corona, these show the extensions reaching to from 3 to 4 solar diameters for the longest streamers.

The plates taken for a search for intramercurial planets have not been carefully examined, but the considerable sky illumination during totality leads Prof. Langley to doubt the possibility of having recorded the images of such faint objects on the plates. Pleione (6·3 magnitude) in the Pleiades, and some fainter stars are, however, recorded on one of the plates.

The expedition seems to have gathered some most valuable data, and to have scored a decided success in every respect; the observations made and the photographs secured promise to be very satisfactory, especially with regard to the primary objects of the expedition.

THE BOARD OF EDUCATION AND ITS CONSULTATIVE COMMITTEE.

IT will be remembered that the Board of Education Act, which received the Royal Assent last year, contained in Section 4 the following provision:

"It shall be lawful for Her Majesty in Council by Order to establish a Consultative Committee, consisting, as to not less than two-thirds, of persons qualified to represent the views of universities and other bodies interested in education, for the purpose of:—

(*a*) framing, with the approval of the Board of Education, regulations for a register of teachers which shall be formed and kept in manner to be provided by the Order in Council; provided that the register so formed shall contain the names of the registered teachers arranged in alphabetical order, with an entry in respect of each teacher showing the date of his registration, and giving a brief record of his qualifications and experience; and

(*b*) advising the Board of Education on any matter referred to the committee by the Board."

The Order in Council nominating the members of the proposed committee and defining its course of procedure, has just been issued, and is a document of considerable public interest and importance. Advisory Boards are not unknown in other departments of the public service, *e.g.* in the India Board and at the Admiralty; but a permanent Consultative Committee of unofficial experts, on the scale and with the powers contemplated in the present Order in Council, is a